

REMARKS

Applicants request favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 71, 73-75, and 77-89 are presented for consideration. Claims 71, 75, 79, 82, and 86 are independent. Claims 71, 75, 79, 82 and 86 have been amended to define still more clearly what Applicants regard as their invention, in terms which distinguish over the art of record. Claim 89 has been added to assure Applicants of the full measure of protection to which they deem themselves entitled. Support for these amended and added claims may be found in the original application, as filed. Therefore, no new matter has been added.

Claims 71, 82 and 83 have been rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent 5,648,874 (Sawaki et al.). Claims 73, 74, 84 and 85 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Sawaki et al. With regard to the claims as currently amended, this rejection is respectfully traversed.

Independent Claim 71 as currently amended is directed to a diffractive optical element used for an optical system of an exposure apparatus. In the diffractive optical element, a peripheral area surrounds an effective area and a light shielding member composed of a laminated layer of Cr oxide and Cr is disposed on the surface of the peripheral area. The laminated layer has an alignment mark at a predetermined position with respect to the center of the effective area and in relation to a holding frame so as to center the effective area in the holding frame.

Independent Claim 82 as currently amended is directed to a diffractive optical element used for an optical system of an exposure apparatus. In the diffractive optical element, a

peripheral area surrounds an effective area. A light shielding member composed of any one of chromium, aluminum, molybdenum, tantalum and tungsten, a laminated structure of any one of chromium, aluminum, molybdenum, tantalum or tungsten and any one of chromium oxide, silicon oxide or aluminum oxide, a compound material of a metal and silicon, and a compound of any one of molybdenum or tungsten and silicon, silicon, or titanium oxide, is disposed on a face of the peripheral area. The light shielding member has an alignment mark at a predetermined position with respect to the center of the effective area and in relation to a holding frame so as to center the effective area in the holding frame.

Sawaki et al. discloses an optical apparatus having a first lens array consisting of plural lenses that form a reduced image in reversed orientation. A second lens array having plural lenses arranged at corresponding positions to the lens of the first lens array form an erected equal magnification image from the reduced image by expanding the reduced image in the given magnification. One or more light shielding films arranged between the first lens array and the second lens array have through openings to pass light discharged from respective lens of the first lens array at positions corresponding to respective lens of the first lens array in opposition to respective lens that pass discharged light from respective lens of the first lens array.

According to the invention defined in independent Claims 71 and 82, a diffractive optical element has a peripheral area surrounding an effective area, a holding frame and a light shielding member on the surface of the peripheral area. The light shielding member has an alignment mark at a predetermined position with respect to the center of the effective area of the diffractive optical element and in relation to the holding frame so as to center the effective area in the holding frame.

Sawaki et al. may teach at lines 58-60 of column 15 that a marker is formed on an end portion of a substrate by etching to determine positions of subsequently formed lens and a light shielding film. In Sawaki et al., the marker is formed at an end of a substrate to determine the position of a later formed light shielding film. As a result, Sawaki et al. is directed away from an alignment mark being part of a light shielding member or placing the alignment mark at a predetermined position in the light shielding member with respect the center of an effective area and in relation to a holding frame. Further, there is no suggestion in Sawaki et al. of any relationship of a marker with respect to a holding frame or the center of an effective area of a diffractive optical element or of an alignment mark positioned to center an effective area in a holding frame. Accordingly, it is not seen that Sawaki et al. teaches or suggests the feature of Claims 71 and 82 of a light shielding film that includes an alignment mark at a predetermined position with respect to the center of the effective area of a diffractive optical element and in relation to a holding frame to center the effective area in the holding frame. In addition, Sawaki et al. does not in any manner suggest use of a diffractive optical system in an exposure apparatus as in Claim 71 and 82. In view of the foregoing, It is believed that Claims 71 and 82 are completely distinguished from Sawaki et al. and are allowable.

It is a further feature of the invention in Claims 73 and 84 that an exposure apparatus exposes a wafer to a pattern of a mask by the optical system including the diffractive optical element of Claims 71 and 82. As clearly disclosed at least at lines 4-7 of column 1 of Sawaki et al., the Sawaki et al. invention "relates to an optical apparatus for reading an image or forming an image to be employed in an image scanner and an LED printer and so forth. As is well known in the art, semiconductor exposure devices for exposing a wafer to a mask pattern are completely

different from the image reading or image forming optical apparatus in which the Sawaki et al. devices are used. Accordingly, it is not seen that there is any motivation for applying Sawaki et al.'s devices relating to image scanners and LED printers to exposure apparatus that expose a wafer to the pattern of a mask. It is therefore believed that Claims 73 and 84 are further distinguished from Sawaki et al. and are allowable.

Claims 75, 77-81 and 86-88 have been rejected under 35 U.S.C. § 103(a) as unpatentable over Sawaki et al. With regard to the claims as currently amended, this rejection is respectfully traversed.

Independent Claim 75 as currently amended is directed to a diffractive optical element used for an optical system of an exposure apparatus. In the diffractive optical element, a peripheral area surrounds an effective area and a light shielding member composed of a material selected from the group of TiC, TiN, ZrC, HfC and HfN is disposed on a surface of the peripheral area. The material disposed on the surface of the peripheral area has an alignment mark at a predetermined position with respect to the center of the effective area and in relation to the holding frame so as to center the effective area in the holding frame.

Independent Claim 79 as currently amended is directed to a diffractive optical element used for an optical system of an exposure apparatus. In the diffractive optical element, a peripheral area surrounds an effective area and a light shielding member composed of an acrylic or epoxy light shielding ink is disposed on the face of the peripheral area. The light shielding member has an alignment mark at a predetermined position with respect to the center of the effective area and in relation to the holding frame so as to center the effective area in the holding frame. The light shielding ink is not exposed to the outside of the diffractive optical element.

Independent Claim 86 as currently amended is directed to a diffractive optical element in which a peripheral area surrounds an effective area and a light shield is disposed on a surface of the peripheral area. The light shielding member has an alignment mark at a predetermined position with respect to a center of the effective area and in relation to the holding frame so as to center the effective area in the holding frame.

It is a feature of Claims 75, 79 and 86 that a light shielding member on the peripheral surface of a diffractive optical element includes an alignment mark at a predetermined position with respect to the center of the diffractive optical element effective area and in relation to the holding frame of the diffractive optical element so as to center the effective area in the holding frame. As discussed with respect to Claims 71 and 82, Sawaki et al. is restricted to teaching forming a marker by etching at the end of a substrate to determine positions of subsequently formed lens and light shielding film. Since Sawaki et al.'s requires the marker to be formed prior to the light shielding film, there is no possible suggestion in Sawaki et al. of a light shielding member including an alignment mark at a predetermined position with respect to the center of the effective area of the diffractive optical element and in relation to the holding frame as in Claims 75, 79 and 86. Further, Sawaki et al. only relates to optical apparatus for reading an image or forming an image to be employed in an image scanner, LED printer and so forth but fails in any manner to suggest any diffractive optical element for use in an exposure apparatus or in an exposure apparatus for exposing a wafer to a mask pattern as in Claims 77, 80 and 87. Accordingly, it is believed that Claims 75, 79 and 86 and claims depending therefrom are completely distinguished from Sawaki et al. and are allowable.

New Claim 89 depends from Claim 71 as currently amended and features a method of manufacturing a diffractive optical element in which a substrate is coated with photoresist and the photoresist is patterned to make the alignment mark of Claim 71 and a pattern to make the effective area. The substrate covered with the patterned resist is etched and the photoresist is peeled. The light shielding member and the alignment mark are formed by forming the laminated layer of Cr oxide and Cr on the peripheral area of the substrate and then attaching the substrate to a holding frame. The features of Claim 89 are shown in Figs. 10, 11, 13 an 14 and are disclosed in the corresponding portions of the specification. No new matter is believed to have been added.

It is a feature of new Claim 89 that the photoresist is patterned into a pattern for making the alignment mark and a pattern to make the effective area. As a result, the predetermined position of the alignment mark with respect to the effective area is maintained by performing patterning of the alignment mark and the effective area with the same photoresist. In contrast to forming an alignment mark and an effective area with the same photoresist of Claim 89, the Sawaki et al. marker is formed by etching prior to forming of lens and light shielding film and is formed to determine positions of the later formed lens and light shielding film rather than centering the effective area in a holding frame. It is therefore believed that Claim 89 is completely distinguished from Sawaki et al. and is allowable.

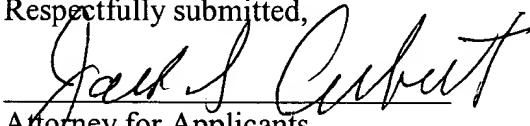
A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable consideration and reconsideration and early passage to issue of the present application.

Applicants' attorney, Steven E. Warner, may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,



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